

Title: Effects of Various Seeding Methods on Multi-Layered Diamond Coatings Deposited via Hot Filament Chemical Vapor Deposition

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Abstract: Multi-layer alternating nanocrystalline diamond (NCD) layer and polycrystalline diamond (PCD) layer was successfully deposited on pretreated tungsten carbide (WC) substrates with various seeding sizes ($<0.1\mu\text{m}$ synthetic, $<0.5\mu\text{m}$ synthetic, $<0.25\mu\text{m}$ natural, $<0.5\mu\text{m}$ natural, and $<1\mu\text{m}$ natural) diamond with and without hammering by silicon carbide. X-rays penetrate through the coating to the substrate from XRD method was able to show strong peaks of diamond relative to WC despite the diamond film being $4\mu\text{m}$ thick only. It is found that substrates with no hammering produce stronger signals. The coating was cross sectioned and analysed using field emission scanning electron microscopy showing the multi-layer with NCD grains that has coalesced and columnar structure for PCD. None of the diamond coating delaminated during cross sectioning showing good adhesion. Raman was able to capture data from the 1-1.6 μm thick NCD layer only while AFM measured the extreme low roughness of the NCD surface.